

## Flasher, 18-mΩ Shunt, Extremely Low Current Consumption

### Description

The bipolar integrated circuit, U644B, is used in relay-controlled automotive flashers where a high level EMC is required. Lamp outage is indicated by frequency doubling during hazard warning as well as direction mode.

If the flasher module provides an 4-pin connector the control pin of U644B (Pin 6) can be used to operate the IC in an extremely low-current mode.

### Features

- Frequency doubling indicates lamp outage
- Frequency independent of temperature and voltage change
- Relay driver output with high current-carrying capacity and low saturation voltage
- Minimum lamp load for flasher operation:  $\geq 1$  W
- Very low susceptibility to EMI
- Protection according to ISO TR7637/1 level 4
- Control input (K1 15)

### Ordering Information

Extended Type Number	Package	Remarks
U644B	DIP8	
U644B-FP	SO8	

### Block Diagram

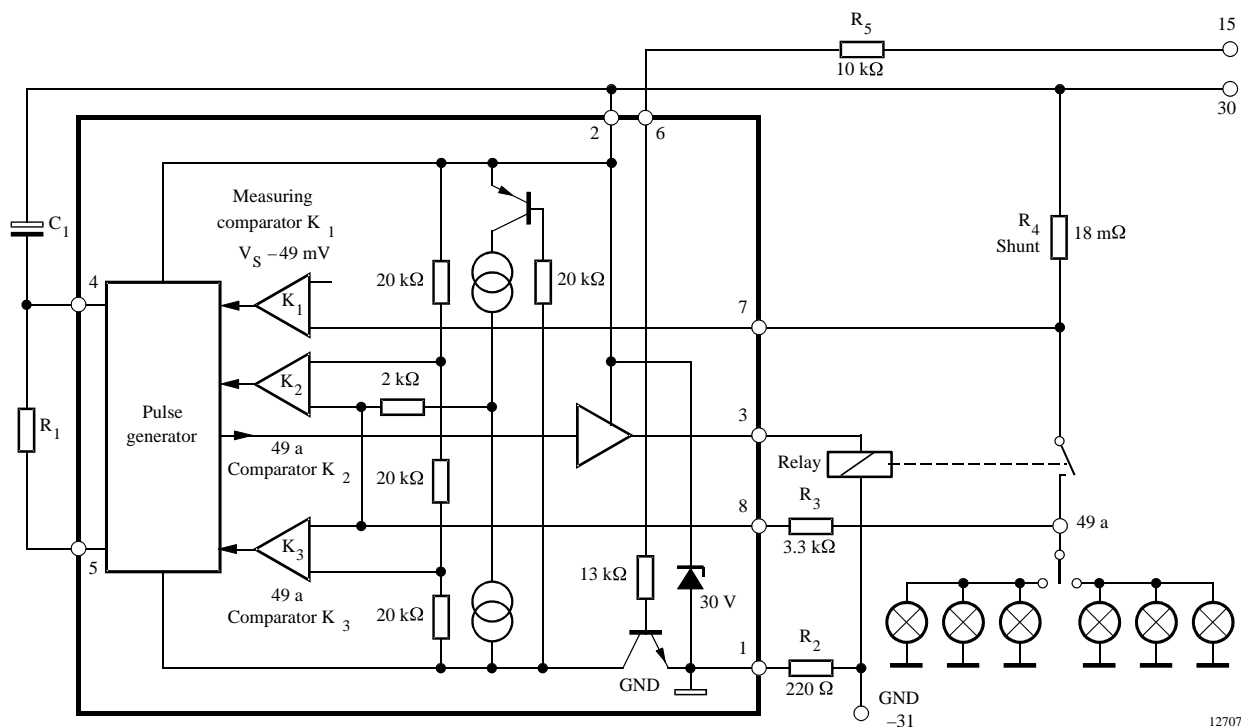


Figure 1. Application circuit as a car flasher with control input  
Resistor R<sub>1</sub>, R<sub>2</sub> and R<sub>3</sub>: 1/4 Watt  
R<sub>2</sub> for protection against continuous reversed polarity: 1 Watt

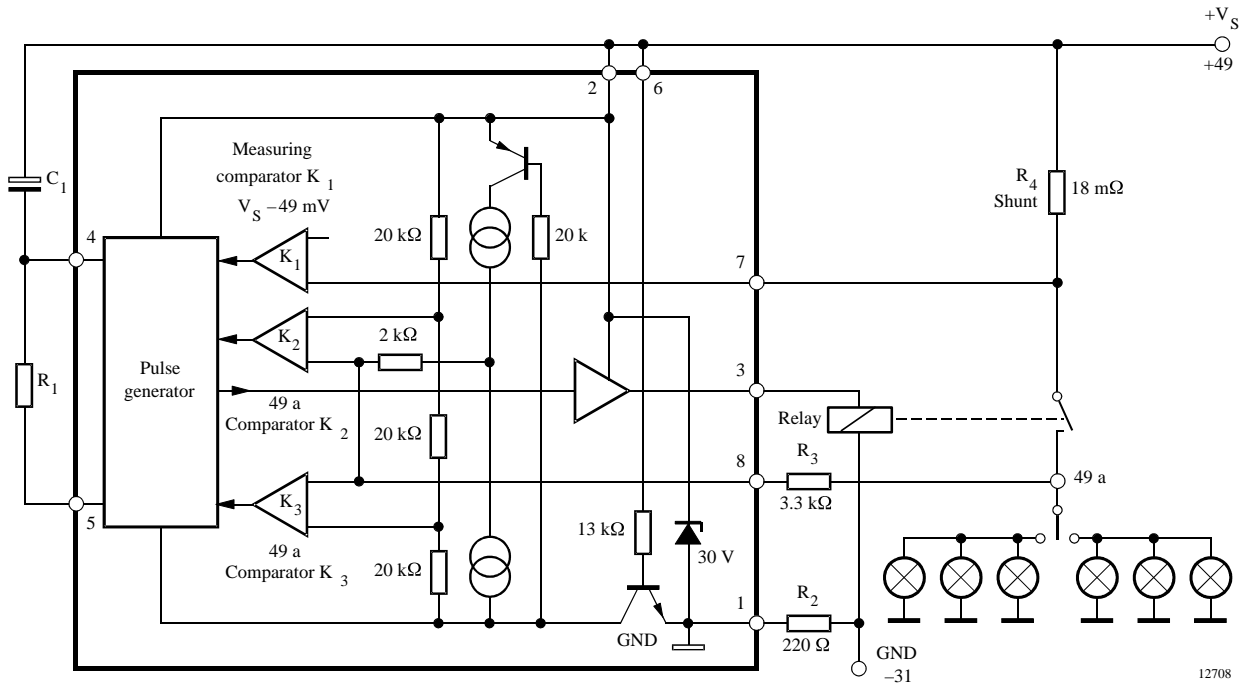


Figure 2. Application circuit as a car flasher without control input  
 Resistor R<sub>1</sub>, R<sub>2</sub> and R<sub>3</sub>: 1/4 Watt  
 R<sub>2</sub> for protection against continuous reversed polarity: 1 Watt

## Application Note

In figure 1, the control input (Pin 6) is used to enable or disable U644B. If the ignition is switched off, the current consumption is less than 50  $\mu$ A.

In figure 2, Pin 6 is bridged to Pin 2, so U644B works like U6043B. Note that the resistor values of R<sub>2</sub> and R<sub>3</sub> are different from the U6043B (see application circuit).

## Pin Description

Pin	Symbol	Function
1	GND	IC ground
2	V <sub>S</sub>	Supply voltage V <sub>S</sub>
3	REL	Relay driver
4	OSC	C <sub>1</sub> Oscillator
5	OSC	R <sub>1</sub> Oscillator
6	V <sub>S</sub>	Supply voltage / or control input
7	LD	Lamp failure detection
8	SI	Start input (49a)

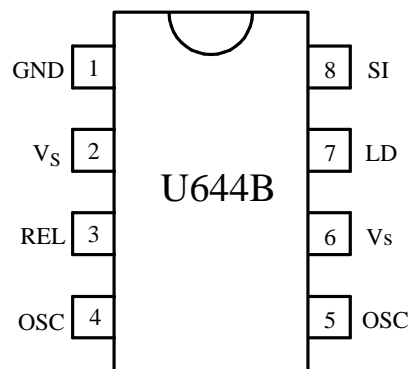


Figure 3. Pinning

## Functional Description

### Pin 1, GND

The integrated circuit is protected against damage via resistor R<sub>2</sub> to ground (–31) in the case of battery reversal. An integrated protection circuit and the external resistances R<sub>1</sub> and R<sub>2</sub> limit the ac-current pulse in the IC.

**Pin 2, Supply voltage, V<sub>S</sub> - Power**  
Connected directly to battery (K1 30).

### Pin 3, Relay control output (driver)

The relay control output is a high-side driver with a low saturation voltage and capable to drive a typical automotive relay with a minimum coil resistance of 60 Ω. An integrated overvoltage detection disables the output at V<sub>S</sub> ≈ 20 V to protect the lamps during jump start

### Pin 4 and 5 Oscillator

Flashing frequency, f<sub>1</sub>, is determined by the R<sub>1</sub>C<sub>1</sub> components as follows (see figure 1):

$$f_1 \approx \frac{1}{R_1 \times C_1 \times 1.5} \text{ Hz}$$

where  $C_1 \leq 47 \mu\text{F}$   
 $R_1 = 6.8 \text{ k}\Omega \text{ to } 510 \text{ k}\Omega$

In the case of a lamp outage (see Pin 7) the oscillator frequency is switched to the lamp outage frequency f<sub>2</sub> with f<sub>2</sub> ≈ 2.2 f<sub>1</sub>.

Duty cycle in normal flashing mode: 50%  
Duty cycle in lamp outage mode: 40% (bright phase)

### Pin 6, Supply voltage, control input

When the IC is powered by the battery Pin 6 is the control input to switch the IC to zero current consumption during stand-by.

### Pin 7, Lamp outage detection

The lamp current is monitored via an external shunt resistor R<sub>4</sub> and an internal comparator K1 with its reference voltage of typ. 49 mV (V<sub>S</sub> = 12 V). The outage of one lamp out of two lamps is detected according to the following calculation:

Nominal current of 1 lamp: 21 W / (V<sub>S</sub> = 12 V):

$$I_{\text{lamp}} = 1.75 \text{ A}$$

Nominal current of 2 lamps: 2 x 21 W / (V<sub>S</sub> = 12 V):

$$I_{\text{lamp}} = 3.5 \text{ A.}$$

The detection threshold is recommended to be set in the middle of the current range: I<sub>outage</sub> ≈ 2.7 A

Thus the shunt resistor is calculated as:

$$R_{\text{sh}} = V_T (\text{K1}) / I_{\text{outage}}$$

$$R_{\text{sh}} = 49 \text{ mV} / 2.7 \text{ A} = 18 \text{ m}\Omega.$$

Comparator K1's reference voltage is matched to the characteristics of filament lamps (see "control signal threshold" in the data part).

The combination of shunt resistor and resistance of wire harness prevents Pin 7 from a too high voltage in the case of shorted lamps.

### Pin 8, Start input

Start condition for flashing: the voltage at Pin 8 has to be below K3 threshold (flasher switch closed).

Humidity and dirt may decrease the resistance between 49 a and GND. If this leakage resistance is > 5 kΩ the IC is still kept in its off-condition. In this case the voltage at Pin 8 is between the thresholds of comparators K2 and K3.

During the bright phase the voltage at pin 8 is above the K2 threshold, during the dark phase it is below the K3 threshold.

For proper start conditions a minimum lamp wattage of 1 W is required.

## Absolute Maximum Ratings

Reference point Pin 1

Parameters		Symbol	Value	Unit
Supply voltage	Pin 2	V <sub>S</sub>	18	V
Surge forward current	t <sub>p</sub> = 0.1 ms	I <sub>FSM</sub>	1.5	A
	t <sub>p</sub> = 300 ms	I <sub>FSM</sub>	1.0	A
	t <sub>p</sub> = 300 ms	I <sub>FSM</sub>	50	mA
Output current	Pin 3	I <sub>O</sub>	0.3	A
Power dissipation	T <sub>amb</sub> = 120°C	P <sub>tot</sub>	230	mW
	T <sub>amb</sub> = 105°C	P <sub>tot</sub>	300	mW
	T <sub>amb</sub> = 60°C	P <sub>tot</sub>	690	mW
	T <sub>amb</sub> = 60°C	P <sub>tot</sub>	560	mW

## Absolute Maximum Ratings (continued)

Parameters	Symbol	Value	Unit
Junction temperature	$T_j$	150	°C
Ambient temperature range	$T_{amb}$	-40 to +120	°C
	$T_{amb}$	-40 to +105	°C
Storage temperature range	$T_{stg}$	-55 to +150	°C

## Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	$R_{thJA}$	110	K/W
	$R_{thJA}$	160	K/W

## Electrical Characteristics

Typical values under normal operation in application circuit figure 1,  $V_S (+49, \text{Pin } 2) = 12 \text{ V}$ .

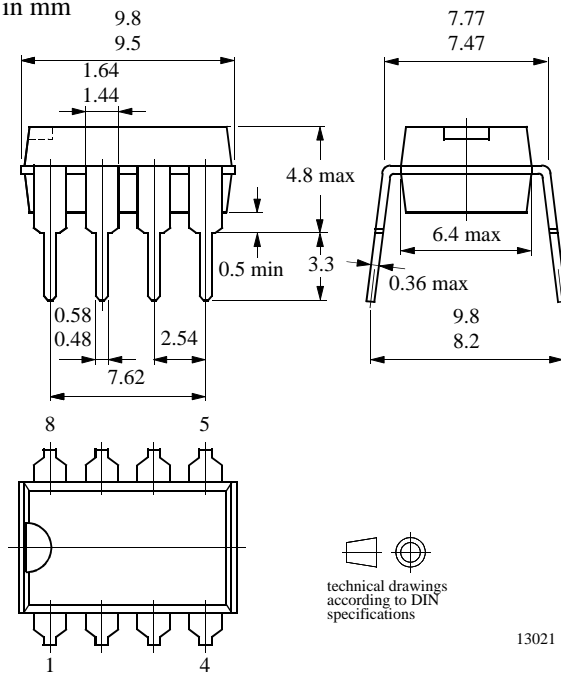
Reference point ground (-31),  $T_{amb} = 25^\circ\text{C}$  unless otherwise specified

Parameters	Test Conditions / Pin	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range	Pin 2	$V_S (+49)$		8 to 18		V
Supply current	Dark phase or stand-by Pin 2	$I_S$		5	7	mA
Supply current	Bright phase Pin 2	$I_S$		6	10	mA
Relay output, saturation voltage	$I_O = 300 \text{ mA}$ Pin 3	$V_O$			1.3	V
Relay output, reverse current	Pin 3	$I_O$			0.1	mA
Relay coil resistance		$R_L$	60			$\Omega$
Relay output overvoltage detection (relay disabled)			19.0	20.2	22.5	V
Start delay (first bright phase)		$t_{on}$			10	ms
Frequency determining resistor		$R_1$	6.8		510	k $\Omega$
Frequency determining capacitor		$C_1$			47	$\mu\text{F}$
Frequency tolerance (normal flashing, basic frequency $f_1$ not including the tolerance of the external components $R_1$ and $C_1$ )		$\Delta f_1$	-6.5		+ 6.5	%
Bright period (basic frequency $f_1$ )		$\Delta f_1$	45		55	%
Bright period (control frequency $f_2$ )		$\Delta f_2$	35		45	%
Frequency increase (lamp failure)		$f_2$	$2.1 \times f_1$		$2.4 \times f_1$	Hz
Control signal threshold	$V_S = 18 \text{ V}$ Pin 7 $V_S = 8 \text{ V}$ Pin 7 $V_S = 13.5 \text{ V}$ Pin 7	$V_{R3}$ $V_{R3}$ $V_{R3}$	53 40.5 47.5	57 43.6 51	61 46.6 54.5	mV mV mV
Resistance between 49a to ground for stand-by		$R_P$		2	5.6	k $\Omega$
Lamp load		$P_L$	1			W

**Package Information**

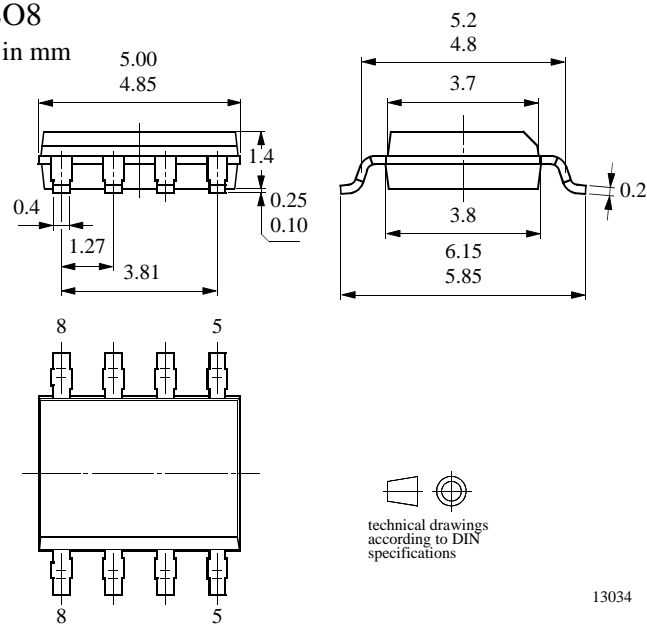
Package DIP8

Dimensions in mm



Package SO8

Dimensions in mm



## Ozone Depleting Substances Policy Statement

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1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

**TEMIC TELEFUNKEN microelectronic GmbH** semiconductor division has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

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